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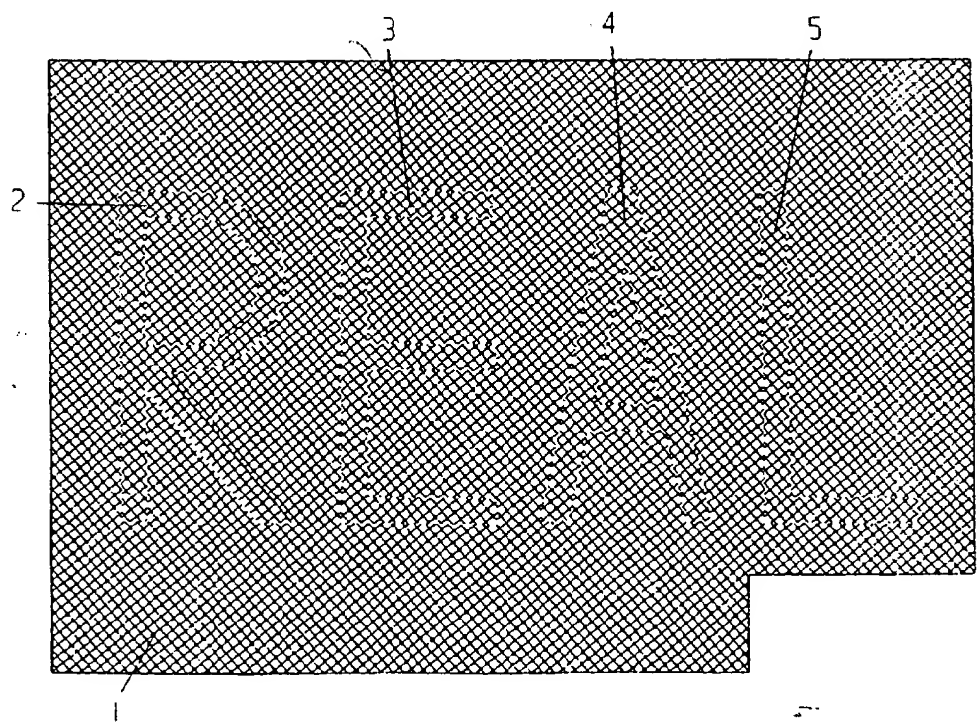
(54) Title: EMBEDDED PRINTED DATA - METHOD AND APPARATUS

(57) Abstract

An article is provided comprising data embedded within the screen (1) of a halftone printing process. The data (2-5) is encoded by the positioning of the centroids of individual elements or dots comprising one or more screens (1) used for printing a document, as distinct from the normal variation of the weight of these dots relative to their spacing to produce the variations in density of conventional halftone printed matter. The embedded data is readily made visible by apparatus which provides interference between the screen (1) comprising the data (2-5) and a reference pattern having a similar spatial frequency. Alternatively the data (2-5) may be detected by an electronic imaging process in which controlled movement of the reference pattern relative to the printed screen provides a series of images which are processed together to extract the embedded data (2-5). The use of a physical reference pattern may be replaced by scanning a document and referencing the positions of screen dots in one location to those in other locations. Inter alia, the invention has application in the field of security printing by allowing the incorporation of security features and other embedded data in halftone printed documents.



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Embedded printed data - Method and Apparatus

This invention is concerned with the field of halftone printing, in which the weight of ink per unit area is controlled by varying, within an array of printed dots, the size of each dot relative to the spaces between neighbouring dots. The dots are typically very small and are not noticed individually. Specifically, the invention is concerned with the embedding of information by the relative positioning of the printed dots.

Background

In certain printed documents, security features are included to prevent unauthorised copying or forgery. One such feature is described in UK Patent No 1599701 ("Burroughs Corporation"). When the document is scanned or copied, the faithfulness of reproduction of different areas within the document by the electro-optical system performing the operation is affected by the different patterns to a different extent, so that this differential becomes clearly visible in the copy.

The regular array used in halftone printing, known as a screen, has a pitch of typically 0.02" to 0.002", corresponding to a spatial frequency of 50 to 500 dots per inch. It is normal to vary the size and shape of these dots, but not the phase of one part of the array with respect to another.

When two periodic screens, one or more of which is transmitting are brought in close proximity, interference or "beating" between their spatial structures may be observed. The fringes produced are known as Moire patterns. The spatial frequency of such a pattern is a direct measure of the difference between the frequencies of the two interfering patterns. A small movement of one pattern with respect to the

second can cause a radical change of density of the Moire pattern at a specific location.

This invention seeks to exploit the characteristics of Moire patterns by using these to embed, in a printed document, information in the form of a shift of phase and/or rotation of the dot pattern relative to a decoding screen, at a plurality of locations.

Statements of Invention

Thus, according to this invention, a carrier of embedded data comprises at least two screens, a first of said screens comprising a first plurality of substantially similar first elements, the centre of gravity of each element of said first plurality being located at a corresponding point within a first extending regular array of points, and a second of said screens comprising a second plurality of substantially similar second elements, the centre of gravity of each element of said second plurality being located at a corresponding point within a second extending regular array of points, wherein there is a difference between said first array and said second array, said difference comprising a relative phase shift between said arrays and/or a difference between the spacing between adjacent points within said first array and the spacing between adjacent points within said second array and/or the relative orientation of the axes of the first array with respect to the axes of the second array.

In preferred embodiments the screens are printed on the same substrate and the embedded data at a location on the substrate comprises elements of the first screen and is substantially void of elements of the second screen.

Preferably the difference between the first array and the second array is substantial so that, in use, a matching reference pattern, combined and substantially aligned with the

first screen provides a pattern of interference comprising regions of constructive and/or destructive interference at locations where the first screen is present, said regions having dimensions substantially greater than the spacing between adjacent elements of the first screen, and there is no substantial simultaneous interference with the second screen, whereby embedded data is observed where the first screen is present.

In certain embodiments, a plurality of screens, may each comprise embedded data at respectively different locations and/or for respectively different spectral components of an illuminant so that, in use, a reference pattern comprising a respective plurality of matching sub-patterns provides interference at each respective location and/or for each respective spectral component.

The screen with embedded data may be printed with ink containing a UV fluorescent dye so that, in use, it is only observed when illuminated with UV light.

The embedded data may take the form of a bar code or its two-dimensional equivalent.

According to another aspect of the invention a reader of embedded data comprises means for locating an embedded data carrier; reference means comprising a reference pattern located in close proximity to said carrier or an image thereof; and means for viewing and/or detecting, in use, the interference pattern formed by the superposition of a screen of said carrier or an image thereof and said reference pattern, whereby said data is read.

Means may be provided for moving the data carrier and/or the reference means relative to each other so that, in use, the interference pattern is changed. One such means is a piezo-electric transducer.

Advantageously the reference pattern is partially transparent. Typically, it comprises a regular array of light absorbing and/or blocking elements.

In certain embodiments the reference pattern comprises different sub-patterns so that in use different regions of the data carrier are referenced to different ones of said sub-patterns.

According to a further aspect of the invention, the reader is provided with electro-optical means, such as an array of photo-detectors or a CCD camera, as viewing and/or detection means co-located with the plane of the interference pattern or an image thereof for recording and/or analysing said pattern.

According to another aspect of the invention, means, such as a frame grabber and data store, is provided for capturing the different interference patterns produced, at successive instants in time, by corresponding movement of the data carrier relative to the reference means, so that the data corresponding to the different interference patterns may be subsequently processed. Combination of such data allows the embedded data to be extracted.

According to yet a further aspect of the invention, a method for reading embedded data comprises detecting the location of a plurality of elements of a data carrier; associating each element with one of at least two screens, each said screen having a respectively different extending regular array of points and each element having its centre of gravity coincident with a different one of said points; and associating embedded data with regions of one of said screens, said regions being distinct from each other.

Description

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a diagrammatic representation of a halftone screen with phase embedded information in accordance with the invention.

Figure 2 is a diagrammatic representation of a reference pattern for use in decoding the information embedded in the screen of Figure 1.

Figure 3 is the result of combining the screen of Figure 1 with the pattern of Figure 2 in accordance with the invention.

Figure 4 shows a reading device for use in accordance with the invention.

Figure 5 is a representation of the formation of a Moire pattern between a regular screen pattern and a spaced reference pattern.

Figure 6 is a two dimensional Moire caused by the rotation of a screen and a matching reference pattern.

Figure 7 shows diagrammatically how embedded data can be related to the phase of the grid pattern at a given location in accordance with the invention.

Figure 8 illustrates a system for capturing image data in accordance with the invention.

A printed screen pattern with phase embedded information is illustrated in Figure 1. Each small area bounded by two pairs of adjacent lines of the regular hatched pattern 1 represents

the cell or space available for an element of a halftone screen. As such, the hatched pattern is not itself printed, in practice, and is employed here for diagrammatic clarity. Instead, an array of substantially similar dots, each with its centre of gravity at the centre of its corresponding cell, is printed. As a specific example of such a dot, a diamond shape, would produce the inverse (negative) of the hatched pattern illustrated with the gaps between adjacent dots providing the lines as illustrated. The degree to which each dot fills its respective cell determines the weight of the screen and thus the density of the printed document. Providing this density is maintained, the position of each dot relative to its neighbours is not normally significant for conventional printed material.

The extending regular array or lattice corresponding to the positions of the centres of gravity of the dots of a second printed screen comprising regions 2 to 5, respectively in the shapes of the letters R E A L , the embedded data, has been shifted minutely relative to the extending regular array corresponding to the centres of gravity of each of the surrounding screen's dots. Given a fine screen pitch, such a difference can be almost imperceptible to the naked eye. However, when the screen or reference pattern represented by the hatched pattern of Figure 2 and corresponding to the same extending regular array as that of region 1 of Figure 1 is superimposed on that of Figure 1, a result very similar to that shown in Figure 3 is achieved. The word "REAL" becomes clearly visible because there are substantial density changes in the regions where there is, through a mismatch, destructive interference between the patterns. This mismatch is caused by a relative lateral displacement, in effect a phase shift, between the screen of Figure 1 and the reference pattern of Figure 2 and, by definition, their corresponding arrays, each of which has the same spatial frequency in this embodiment. In this example, the paper of the document comprises one substrate with two screens printed on it. One of these

comprises the embedded data, the other its surroundings. In other words, the data at any specific location comprises elements of one of the screens and is void of elements of the other screen.

A simple reader for viewing such embedded information is shown in Figure 4. A carrier 6 supports the printed document 7. A glass cover plate 8, shown in a hinged open position, carries a partially transmitting reference pattern 9 on its upper surface. For viewing, plate 8 is lowered 10 and edge illuminated by a strip light 11. In order to ensure that sufficient light is directed towards document 7, below plate 8, some diffusion may be provided, if necessary, at its top surface, by incorporating a white backing layer underneath each of the opaque dots of reference pattern 9. The space between the dots the surface remains transparent for viewing.

The spatial frequency of pattern 9 need not be the same as that of the screen of document 7. The formation of a so-called Moire pattern between these spatial frequencies is illustrated with the aid of Figure 5 which shows, in section, two patterns in a spaced configuration.

In Figure 5, a printed pattern 12 is spaced from a transmission reference pattern 13 by a distance t . In practice, this separation is achieved with a glass substrate as shown in Figure 4 and the actual thickness of this glass would be t x n, where n is the refractive index of the glass, in order to compensate for the latter. The pitch of pattern 12 is p_1 and that of pattern 13 is p_2 . The transmission of light is optimal in the directions indicated by the bundles of rays 14 to 17 thus forming a modulated light pattern of maximum contrast at plane 18.

It may be shown that the distance D of plane 18 from pattern 12 is given by the expression:-

$$D = t \times p_2 / (p_1 - p_2)$$

and that the period p_3 of the resulting interference pattern or Moire at this plane is given by the expression:-

$$p_3 = p_1 \times p_2 / (p_1 - p_2)$$

It will also be apparent that the positions of the maxima of this modulation are directly opposite those points at which patterns 12 and 13 are in phase. A movement of one pattern with respect to the other of only one half of the original pitch will change the phase of the Moire by 180 degrees. This characteristic behaviour is one of the keys to the current invention. By very small changes in the positions of the screen patterns in different regions of the printed document, embedded information, either visual or machine readable, may, in effect, be phase encoded in the screen used to produce the halftone printed document. By placing an array of photo-detectors at plane 18, the Möire pattern may be detected and subsequently analysed.

A pattern (having a finite period of its own and often referred to as a Moire) is produced by a mismatch between the periods of a data-carrying printed pattern and a corresponding reference pattern. This mismatch can be between the intrinsic wavelengths of each respective pattern, or can result from a deliberate misalignment of two regular and equivalent patterns. The typical dimensions of the regions of constructive and destructive interference (in other words a dimension comparable to half the wavelength of the Moire), when there is substantial alignment between the printed screen pattern and the reference pattern will be substantially greater than the spacing between the adjacent dots or elements comprising the screen or reference pattern. The latter effect is illustrated in Figure 6. Here two hatch patterns have been superimposed and one is rotated by a small amount with respect to the other. The result is an alternating array of

constructive 19 and destructive 20 smaller regions. In Figure 7 one of the small destructive region 21 of Figure 6 has been transformed in to a constructive region 22 by a very small local variation in the position of the data-carrying pattern in this region. Whilst in this example the boundaries of this square region are clearly visible as discontinuities in the hatch pattern, this need not be the case in practice if the local density of the printed screen is controlled carefully by the positioning and scaling of its constituent dots.

What is not illustrated explicitly is the fact that, when there is no substantial alignment between a screen and reference pattern, the wavelength of any resultant Moire will be very short and the modulation effect can be ignored by the human eye or a suitably constructed detection system. In this way, it is often convenient to distinguish the embedded data from its surroundings

The invention may be applied in a number of ways. The information embedded in the printed screen may simply be made visible to the user by use of a suitable reference pattern.

The screen which carries the embedded information may be printed using ink which only becomes visible when subjected to UV light, when it fluoresces in the visible region.

Whilst a regular reference pattern has been illustrated, the reference pattern may be composed of regions each of which has a different spatial frequency and/or orientation.

A series of data bits may be encoded within the document so that, when read either simultaneously or in sequence, such bits form a bar code or its two-dimensional equivalent.

Whilst the embodiments illustrated have relied on a reference pattern which is physically separate from the data-carrying pattern, a scanning device could be used to digitise the

detailed structure of a printed document and the position of the digitised screen in certain regions of the document may be used as the spatial phase datum for other data-carrying regions. In this manner, the data is spatially phase encoded.

A single document may comprise screens in different colours. The phase of each of these may be modified in accordance with the invention. A specific colour may be used to provide the reference screen.

Square arrays have been illustrated. Patterns may be comprised of hexagonal close packed arrangements or have different periods in two orthogonal directions. Screen dots need not be square or diamond shaped, but may be elongate or round.

An embodiment of the invention which is insensitive to the absolute positioning of the reference pattern, relying only on incremental motion of this pattern relative to the data carrier and establishing the differences between the Moire patterns formed upon such successive movements, is now described.

The interference between a data carrier and a reference pattern is illustrated with the aid of Figures 1 to 3. Those regions of the pattern of Figure 1 which are in phase with the superimposed pattern of Figure 2 appear unchanged, whereas the out of phase regions display a clear increase in optical density. The relative positioning of the two patterns must be extremely precise to achieve this. In fact, a relative movement of one half of the pitch of the reference pattern will completely reverse the effect. Consequently, two patterns which differ by a small amount will display beats which appear in the form of a spatially periodic modulation (in one or two dimensions), the wavelength of which corresponds to the difference in spatial frequency between the two patterns in any given direction. A movement of one pattern by one half of its pitch relative to the second pattern will change the

result by 180 degrees at any given point, dark regions becoming light and vice versa.

In general, the modulation pattern constituting the Moire will tend to obscure the detail of the embedded data. The embodiment described below overcomes this problem.

The embedded data may be encoded by use of a pattern having a pitch which substantially matches the reference pattern, whilst the surrounding pattern does not do so, either because its pitch is sufficiently different or because it is laid down at an angle which causes a substantial mismatch with the reference pattern. In this case, a large time varying modulation of image density will be observed at any point in regions of embedded data, when the reference pattern is moved relative to it, and little or no modulation will be observed in the surrounding regions. This relies on an image capture system in which any high spatial frequencies (as might occur between two badly matched patterns) are filtered out by virtue of the system's resolution. A suitable choice of CCD camera and image magnification may be used to ensure this.

If the reference pattern is caused, by use of a small transducer, to move in three small increments, each of one quarter of the intrinsic pitch of the pattern, then four images may be observed. At any given point the density value (V_1 to V_4) of the four different but closely related images may be approximated by expressions having a periodic form, such as:-

$$V_1 = M \sin(kx + p) + B \quad (1)$$

$$V_2 = M \sin(kx + 90 + p) + B \quad (2)$$

$$V_3 = M \sin(kx + 180 + p) + B \quad (3)$$

$$V_4 = M \sin(kx + 270 + p) + B \quad (4)$$

By combining these values in the proper way at every point of the field of interest, the spatial frequency k and arbitrary starting phase p may be eliminated to yield M, the absolute modulation depth, and B, which represents the general density of the printed document as subject to the available illumination at that point. A normalised value for the embedded data E is obtained by dividing M by B. The following relationships provide the result we require:-

$$D_{13} = V_1 - V_3 = 2M \sin(kx + p) \qquad (5)$$

$$D_{24} = V_2 - V_4 = 2M \cos(kx + p) \qquad (6)$$

$$B = V_1 - D_{13} / 2 \qquad (7)$$

$$E = (D_{13}^2 + D_{24}^2)^{1/2}/(2B) \qquad (8)$$

It will be clear that a video camera having the appropriate resolution and a suitable frame grabber and data store may be used to capture the images successively, provided the movement of the reference pattern relative to the data carrier is synchronised with the image capturing process. By combining the values of the four images at each point on a corresponding pixel by pixel basis using relationships similar in form to (5) to (8) above, a clear image of the embedded data may be extracted for display on a suitable display device, such as a graphics terminal. Alternatively this data may be directly processed by suitable software to carry out the required validation procedure or other data processing requirement.

The above relationships have treated the Moire pattern as having a modulation along the X-axis. No account has been taken of modulation in the orthogonal (Y-axis) direction. As illustrated in Figures 6 and 7, such modulation will occur given two-dimensional arrays of elements or dots in both decoding (reference) screen and image data, when there is a

small relative rotation between them. In such a case, phase changes and thus movement of the Moire are advantageously introduced in a two-dimensional manner and analysed accordingly to yield the modulation depth and print density.

Figure 8 illustrates apparatus for use in accordance with the above principles. Document 23 is illuminated by lamp 24 and an image thereof is produced by lens 25 in the plane of a transparent plate 26 which carries a reference pattern (not shown). The reference pattern matches that of the screen used to print the embedded data on to document 23, after allowing for the reduction in scale introduced by lens 25. Condenser lenses 27A and 27B re-image the combination of the document's image and the reference pattern through the pupil of a CCD camera 28. Provided the scale and orientation of the pattern on plate 26 match that of the image of document 23, a Moire pattern is created and captured by camera 28. A position transducer 29 of the piezo-electric bimorph type has two electrodes. When a voltage is applied across these through terminals 30A and 30B, the transducer flexes and moves plate 26 in its own plane. The distance moved is proportional to the voltage applied. In this way, the phase relationship between the pattern of the decoder (reference pattern) and the pattern of dots on the printed document is altered in accordance with the invention. A frame store 31 is used to capture the resulting sequence of images which are then processed as already described.

Though not shown in Figure 8, a second transducer may provide movement of decoder 26 in a direction orthogonal to that provided by transducer 29. This can be advantageous where the array of dots in the pattern is two-dimensional in order to deal with registration errors, different screen orientations and two-dimensional analysis of the Moire as indicated above. Unlike the embodiment of Figure 5, in the embodiment of Figure 8, there is no spatial separation between the reference pattern and the corresponding image of document 23, and this

composite image is imaged directly onto the CCD array of camera 28. In this manner both embedded and conventionally printed data are captured without loss of resolution.

It is frequently advantageous to use a computer to analyse the behaviour of the modulation of the Moire pattern as a function of print density and such behaviour, though periodic, will often deviate from the form described above. Provided this behaviour is parameterised adequately, then the principles of this invention may be applied and embedded data extracted thereby.

Whilst it is assumed in the embodiment described with reference to Figure 8 that there will only be a substantial Moire in regions comprising embedded data, this need not always be the case. There may be a detectable Moire in the surrounding regions, but it will typically have a different wavelength and/or orientation. In such a case, suitable processing of image data using algorithms similar to those already illustrated may be used to distinguish the surrounding areas from those of interest.

CLAIMS:-

1. A carrier of embedded data comprising at least two screens, a first of said screens comprising a first plurality of substantially similar first elements, the centre of gravity of each element of said first plurality being located at a corresponding point within a first extending regular array of points, and a second of said screens comprising a second plurality of substantially similar second elements, the centre of gravity of each element of said second plurality being located at a corresponding point within a second extending regular array of points, wherein there is a difference between said first array and said second array, said difference comprising a relative phase shift between said arrays and/or a difference between the spacing between adjacent points within said first array and the spacing between adjacent points within said second array and/or the relative orientation of the axes of the first array with respect to the axes of the second array.

2. The data carrier according to Claim 1 having a substrate comprising the first screen and the second screen and the embedded data at a location on said substrate comprises elements of said first screen and is substantially void of elements of said second screen.

3. The data carrier according to Claim 3 in which the screens are printed on the substrate.

4. The data carrier according to any previous claim in which the difference between the first array and the second array is substantial so that, in use, a matching reference pattern, combined and substantially aligned with the first screen provides a pattern of interference comprising regions of constructive and/or destructive interference at locations where said first screen is

present, said regions having dimensions substantially greater than the spacing between adjacent elements of said first screen, and there is no substantial simultaneous interference with the second screen, whereby embedded data is observed where said first screen is present.

5. The data carrier according to any preceding claim comprising a plurality of said first screens, each of said first screens comprising embedded data at respectively different locations and/or for respectively different spectral components of an illuminant so that, in use, a reference pattern comprising a respective plurality of matching sub-patterns provides interference at each respective location and/or for each respective spectral component.

6. The data carrier according to Claim 2 or Claim 3 in which the screen comprising embedded data comprises a UV fluorescent dye so that, in use, it is only observed when illuminated with UV light.

7. The data carrier according to any preceding claim in which the embedded data is in the form of a bar code or the two-dimensional equivalent of a bar code.

8. A reader of embedded data comprising means for locating a carrier comprising a screen comprising embedded data; reference means comprising a reference pattern located in close proximity to said carrier or an image thereof; and means for viewing and/or detecting, in use, the interference pattern formed by the superposition of a screen of said carrier or an image thereof and said reference pattern, whereby said data is read.

9. A reader of embedded data comprising means for locating the carrier of Claim 1 said carrier comprising, in use, embedded data; reference means comprising a reference pattern located in close proximity to said carrier or an image thereof; and means for viewing and/or detecting, in use, the interference pattern formed by the superposition of a screen of said carrier or an image thereof and said reference pattern, whereby said data is read.

10. The reader according to Claim 8 or Claim 9 comprising means for moving the locating means and/or the reference means in or parallel to the plane of said reference means so that, in use, the interference pattern is changed.

11. The reader according to any of Claims 8 to 10 in which the reference pattern is partially transparent.

12. The reader according to Claim 11 in which the reference pattern comprises a regular array of light absorbing and/or blocking elements.

13. The reader according to Claim 8 or Claim 9 in which the reference pattern comprises different sub-patterns so that in use different regions of the data carrier are referenced to different ones of said sub-patterns.

14. The reader according to Claim 8 or Claim 9 in which the viewing and/or detection means comprises electro-optical means co-located with the plane of the interference pattern or an image thereof for recording and/or analysing said interference pattern.

15. The reader according to Claim 10 wherein the viewing and/or detection means comprises electro-optical means for capturing, in use, the different interference patterns produced at successive instants in time by corresponding movement by the movement means of the

locating means and/or the reference means; and means for storing said different interference patterns as data for subsequent processing.

16. The reader according to Claim 15 including means for combining the data corresponding to the different interference patterns to provide the embedded data.

17. The reader according to any one of Claims 14 to 16 in which the electro-optical means is a CCD camera.

18. The reader according to any one of Claims 14 to 17 in which the movement means is a piezo-electric transducer.

19. A method for reading embedded data comprising detecting the location of a plurality of elements within a data carrier; associating each element with one of at least two screens, each said screen corresponding to a respectively different extending regular array of points and each element having its centre of gravity coincident with a different one of said points; and associating embedded data with a plurality of regions of one of said screens, said regions being distinct from each other.

20. A method for reading embedded data comprising locating the carrier of Claim 1 said carrier having, in use, embedded data; locating reference means comprising a reference pattern in close proximity to said carrier or an image thereof; and viewing and/or detecting the interference pattern formed by the superposition of a screen of said carrier or an image thereof and said reference pattern.

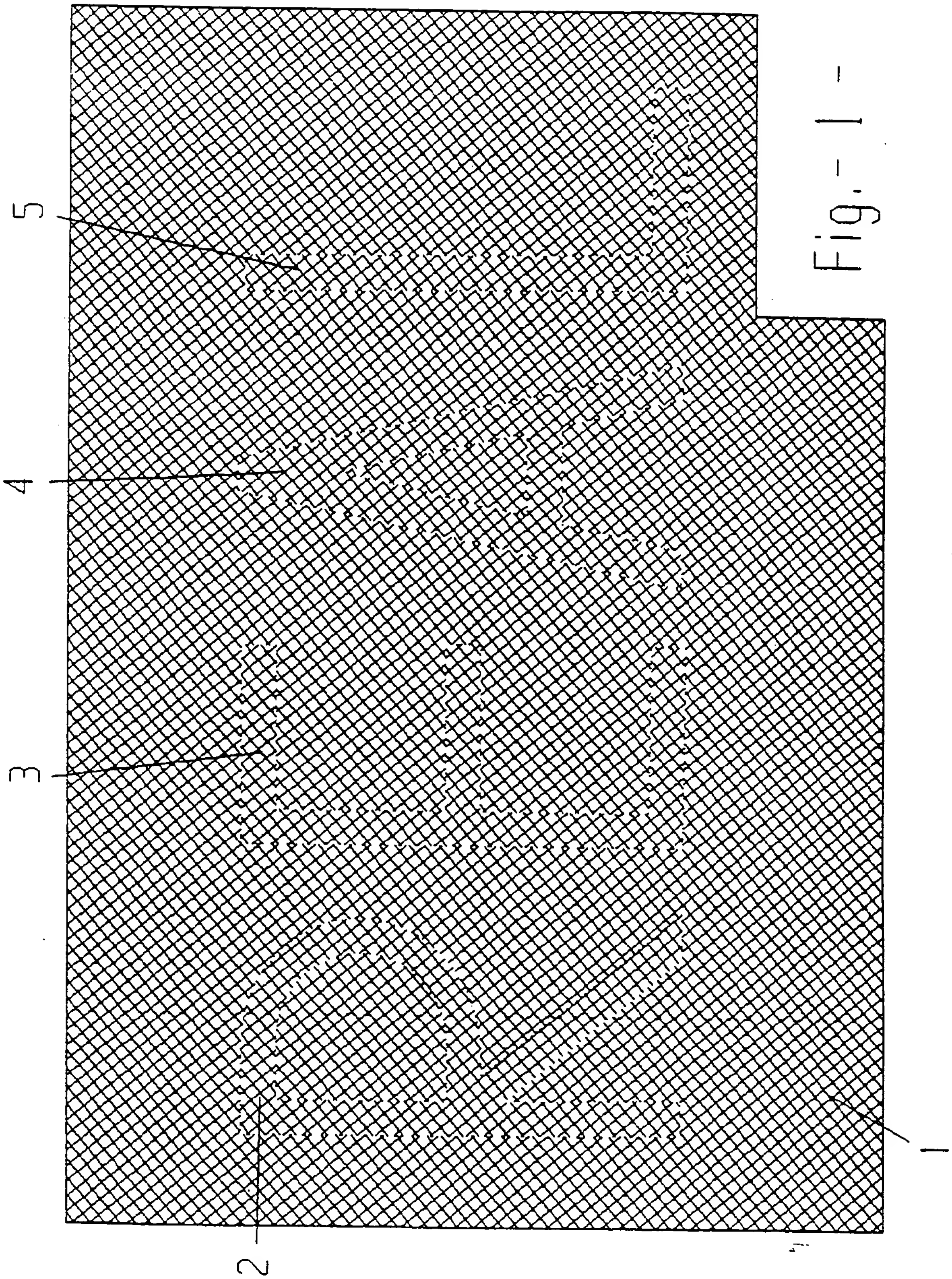

Fig.-1-

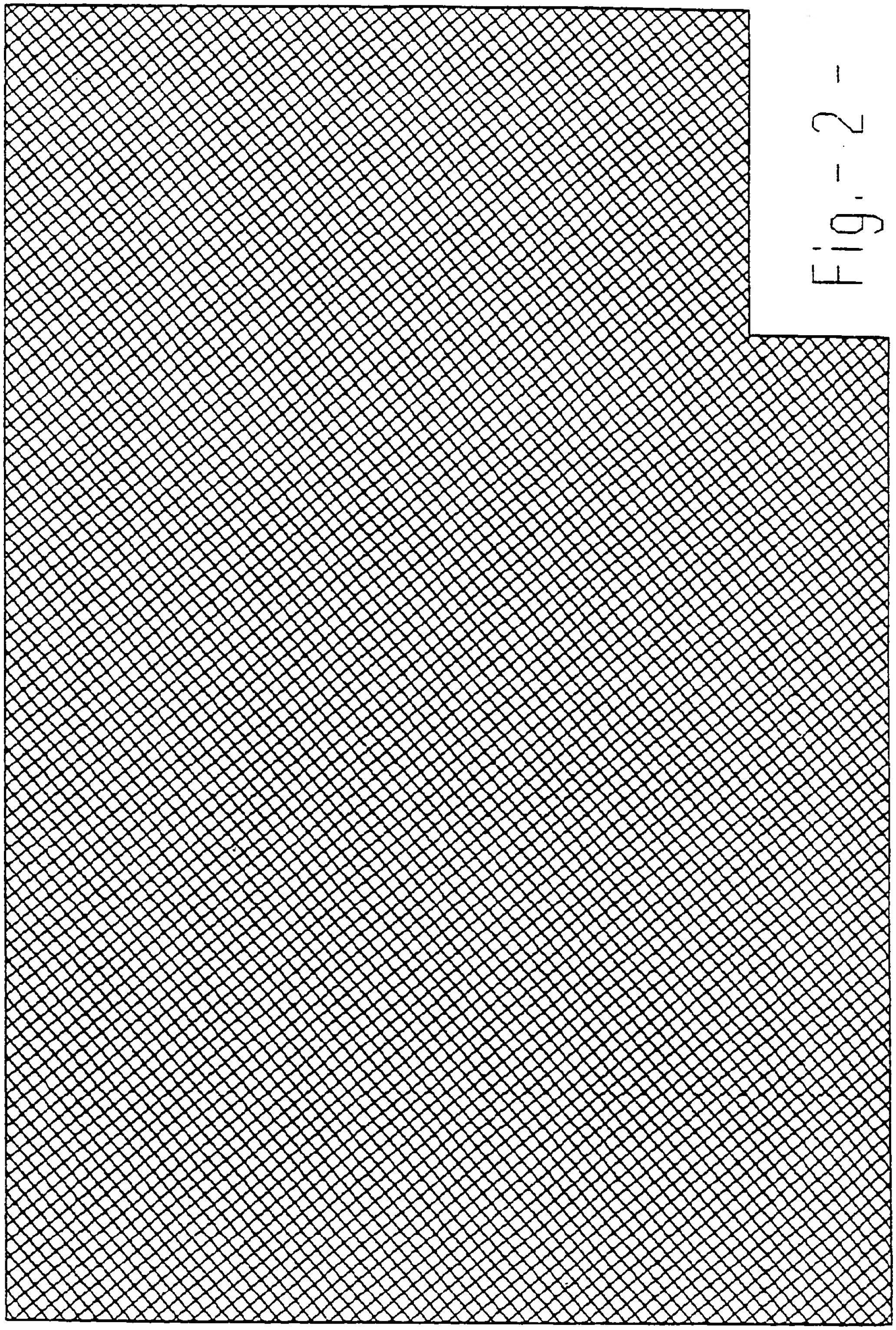

Fig. - 2 -

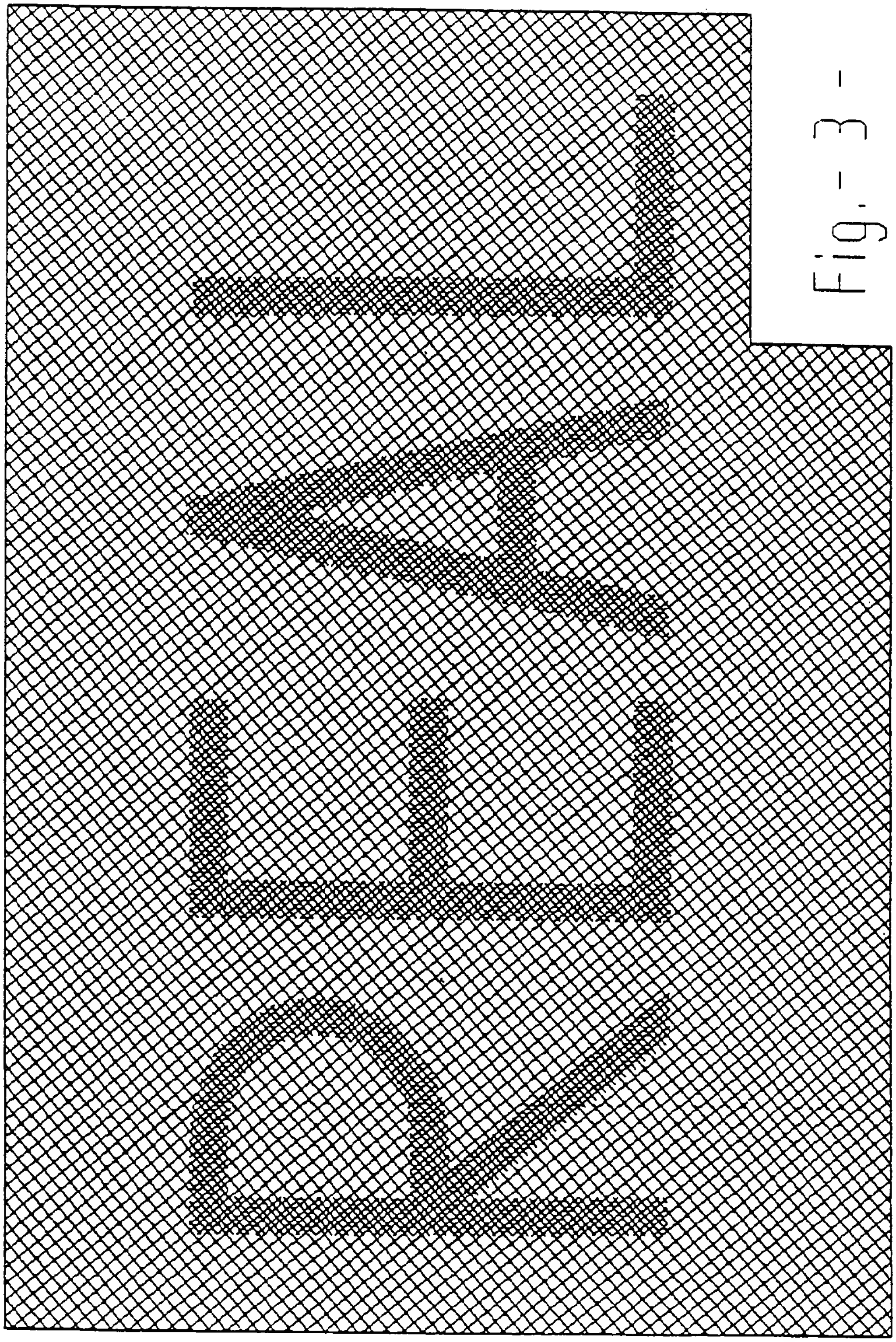

Fig. - 3 -

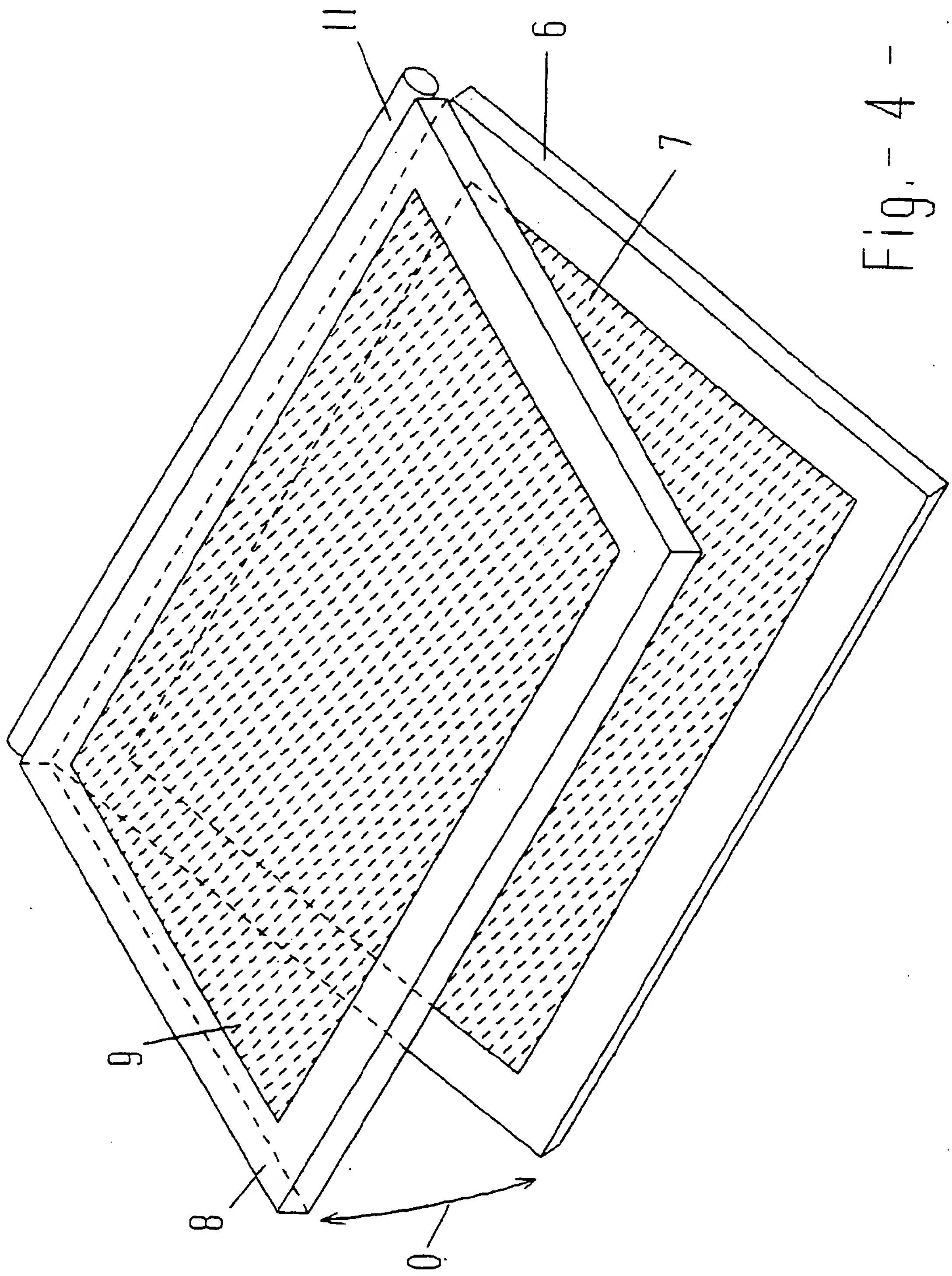

Fig. - 4 -

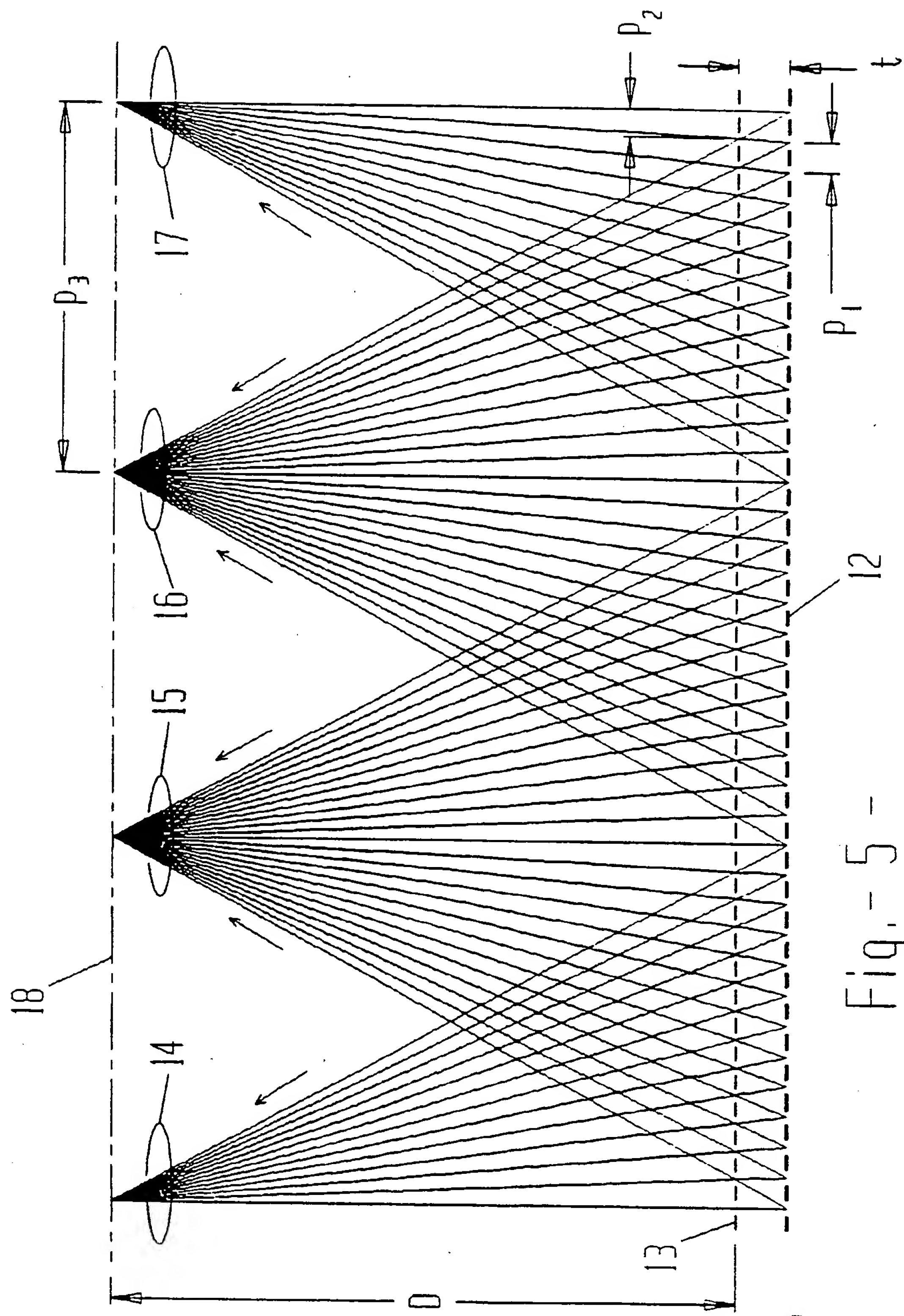

Fig. - 5 -

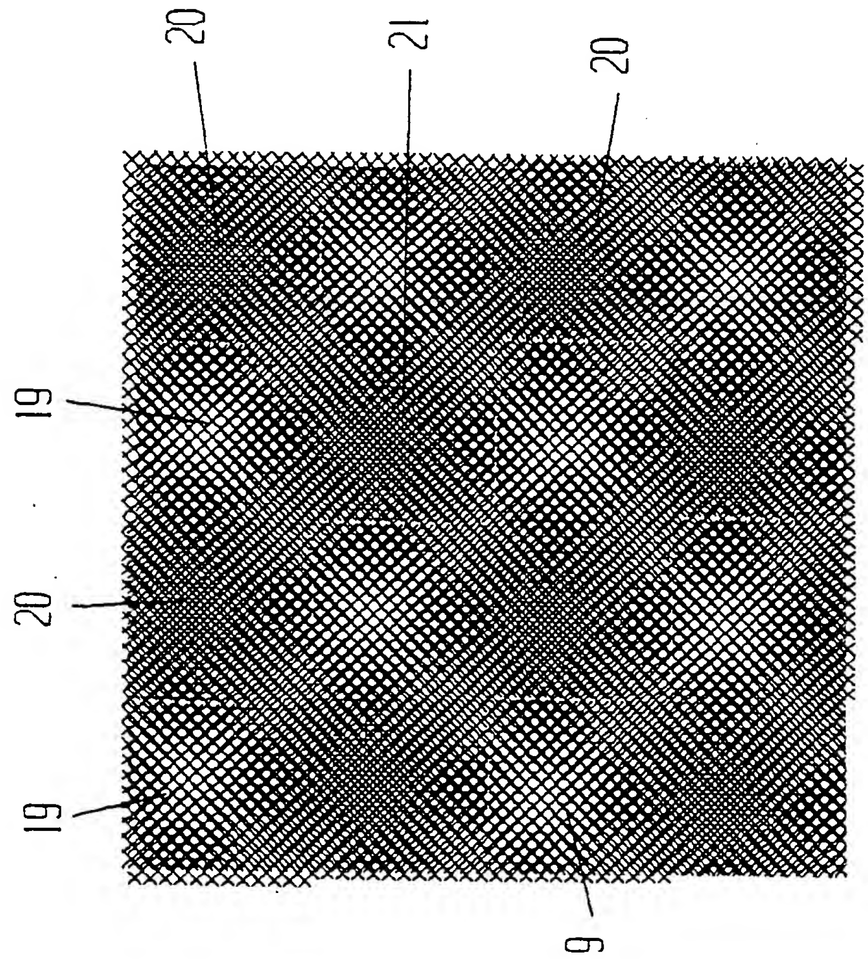

Fig. - 6 -

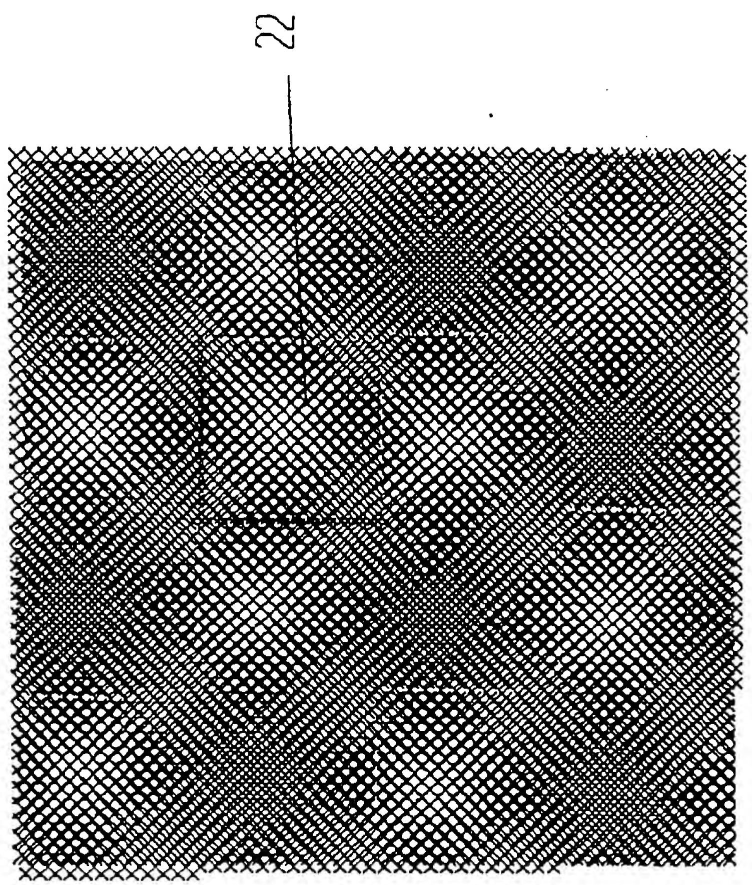

Fig. - 7 -

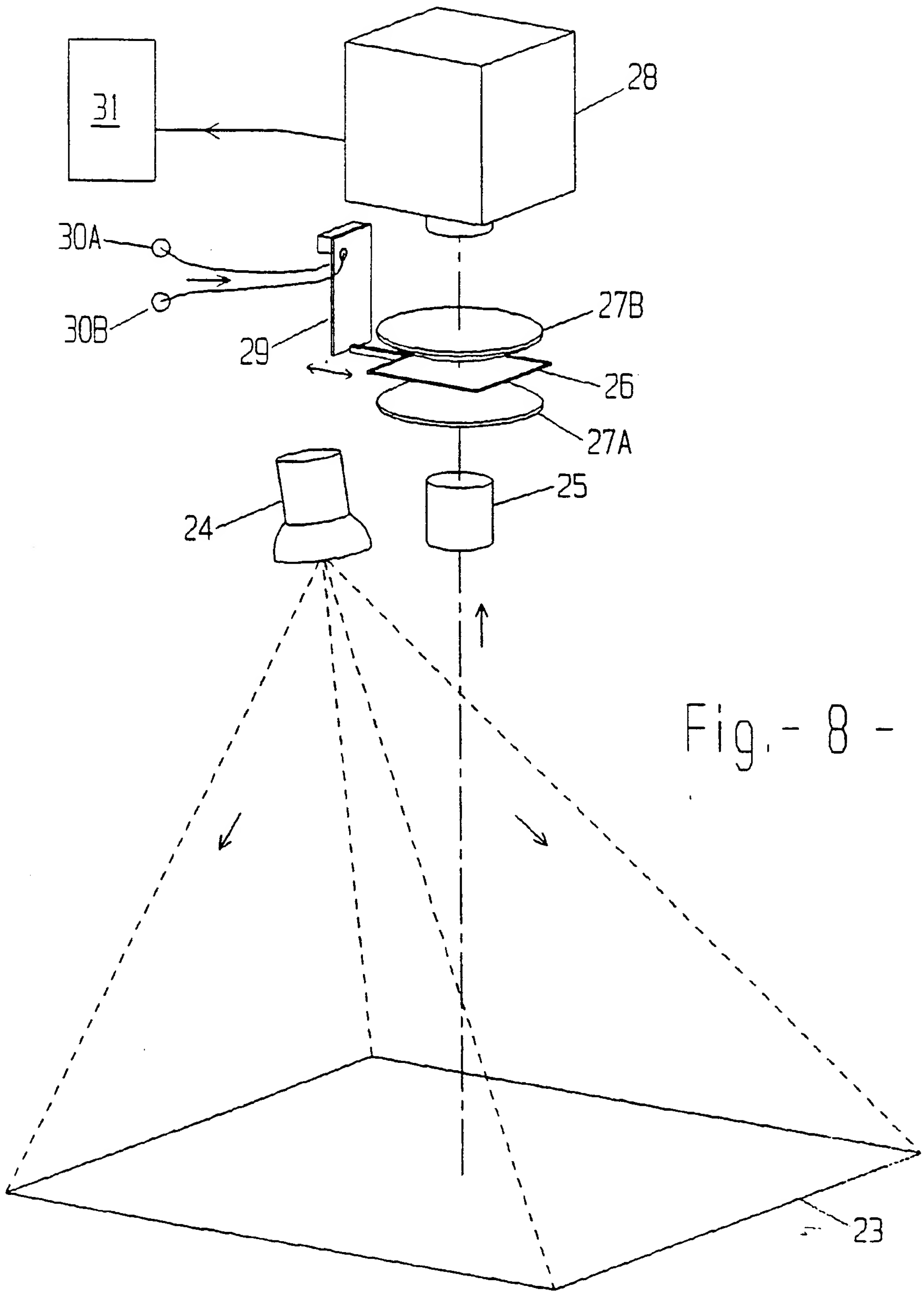

Fig.- 8 -

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 94/01710

A. CLASSIFICATION OF SUBJECT MATTER

B 44 F 1/12

According to International Patent Classification (IPC) or to both national classification and IPC 6

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B 44 F 1/00,G 03 F 9/00,B 41 M 3/00,G 01 B 11/00,
H 01 J 29/00,G 03 F 5/00,B 41 M 5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB, A, 1 352 839 (GORDON) 15 May 1974 (15.05.74), figs; page 2, line 93 - - page 3, line 62; claims 1-7.	1-5, 8-14, 19,20
A	figs; abstract; claims.	15-18
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Y	US, A, 4 649 324 (GUERRA) 10 March 1987 (10.03.87), figs; column 4, lines 8-26; claim 1.	1-5, 8-14, 19,20
A	figs; abstract; claims.	15-18
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Y	EP, A1, 0 520 363 (CANADIAN BANK) 30 December 1992 (30.12.92), fig. 4,5; column 3,	1-5, 19,20

[X] Further documents are listed in the continuation of box C.

[ ] Patent family members are listed in annex.

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Date of the actual completion of the international search: 21 October 1994

Date of mailing of the international search report: 11. 11.94

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	lines 21-37; claims 1-3.	
A	figs; abstract; claims.	6-18
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Y	EP, A1, 0 534 720 (LEVIEN) 31 March 1993 (31.03.93), fig. 1-3; abstract; column 4, lines 3-42.	1-5, 19,20
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A	GB, A, 1 138 011 (CANADIAN BANK) 27 December 1968 (27.12.68), the whole document.	1-5
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A	DE, A1, 3 338 828 (DAINIPPON) 03 May 1984 (03.05.84), figs; abstract; claims.	1-5

ANHANG | ANNEX | ANNEXE

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

to the International Search Report to the International Patent Application No.

au rapport de recherche international relatif à la demande de brevet international n°

PCT/GB 94/01710 SAE 93990

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche international visée ci-dessus. Les reseignements fournis sont donnés à titre indicatif et n'engagent pas la responsibilité de l'Office.

Im Recherchenbericht angeführtes Patentdokument / Patent document cited in search report / Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung / Publication date / Date de publication	Mitglied(er) der Patentfamilie / Patent family member(s) / Membre(s) de la famille de brevets	Datum der Veröffentlichung / Publication date / Date de publication
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